

## CVG-SAB-WCA-TF

### Raspberry Pi based HD IP Camera for Explosive Atmospheres



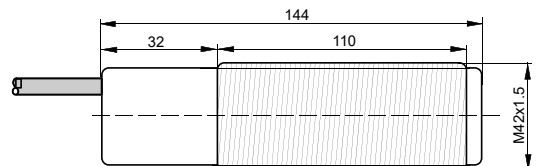
- Video streaming up to 1920x1080 pixels
- Video streaming up to 90fps
- Supports RTSP
- Photos up to 3280x2464 pixels
- Integrated bar code detection capability
- Configuration and control via Modbus TCP
- Automatic or manual shutter, ISO and white balance
- IEEE 802.3af-2003 compliant Power over Ethernet (PoE)

Technical Data	CVG-SAB-WCA-TF				
Gas Ex protection designation	II 2(1)G Ex db [op is Ga] IIC T4 Gb				
Dust Ex protection designation	II 2(1)D Ex tb [op is Da] IIIC T135°C Db				
For use in Ex Zones	(0), 1, 2, (20), 21 and 22				
Light Source	Four white (6850K) InGaN LEDs, viewing angle $2\theta_{\frac{1}{2}} = 40^\circ$				
Interface	10/100Mbps Ethernet (please connect to a 100Mbps or 1Gbps network for full performance)				
Maximum optical radiant power	$\leq 35\text{mW}$				
Maximum optical radiant intensity	$\leq 5\text{mW}/\text{mm}^2$				
Pollution degree	According to IEC 60664-1:2007 : 4				
Optical filter	No filter				
Camera focus	600mm, fix				
Field of view (FOV)	64° horizontally and 48° vertically (29mm full frame equivalent)				
Image sensor	Sony IMX 219, 1/4", 8MP				
Focal ratio (F-Stop)	f/2.0				
Color depth	24 bit (True Color)				
Power supply type	IEEE 802.3af-2003 compliant Power over Ethernet (PoE)				
Maximum power dissipation	3.4W, class 1				
Bootup time	$t_b \approx 90\text{s}$				
Configuration and control interface	via Modbus TCP at port 502, big endianness for word and byte order, recommended timeout: 10s				
IPv4 configuration	Automatic IPv4 address retrieval via DHCP and one static address, default is 192.168.200.200 with subnet mask 255.255.255.0				
IPv6 configuration	Automatic IPv6 address retrieval via DHCPv6, using SLAAC as fallback				
Housing	M42, material: stainless steel 1.4404				
Video stream codec	H.264 encoded with 0.5 to 20 Mbit/s				
Enclosure rating	IP67				
Optical window	Multiple layers of Corning Gorilla Glas 3				
Video stream transfer	Real Time Streaming Protocol (RTSP), accessible at port 554 with url "/live" with up to three clients, e.g. rtsp://192.168.200.200:554/live				
Weight	650g without cable				
Delay of video feed	< 200 ms				
Modes of operation	000: Standard video, 1640x1232, 30 fps, 8 Mbit/s 001: High frame rate, 640x480, 90 fps, 10 Mbit/s, cropped field of view: 25° by 19° 002: Low bandwidth, 640x480, 15 fps, 0.5 Mbit/s 003: Full HD 1080p, 1920x1080, 30 fps, 10 Mbit/s, cropped field of view: 37° by 21° 004: HD 720p, 1280x720, 30 fps, 5 Mbit/s, cropped field of view: 52° by 35° 005: Barcode mode, 640x480, cropped field of view: 25° by 18° 006: HD Barcode mode, 1920x1080, cropped field of view: 37° by 21° 1006: Image mode, 3280x2464				
Embedded computer	Raspberry Pi with customized Rasbian Stretch				
Ambient working temperature range, $T_{amb}$	0°C up to +50°C				
Storage temperature range	-20°C up to +75°C				
Relative humidity	15% to 90%				
Supported 2D codes	QR-Code according to IEC 18004:2015-02				
Supported bar codes	Code 128, Code 39, EAN-8, EAN-13, Interleaved 2 of 5, UPC-A and UPC-E				
Image inspection	Image comparison and a basic object detector and counter				
Connection cable	Length: 5m, Cat.5e industrial Ethernet cable type LEONI MegaLine D1-20 S/U superflex 4P 11Y, drag chain suitable ( $\approx 5$ million bending cycles with bending radius $R_{min} \geq 20\text{mm}$ ), chemical resistant				
Accessories	<table border="0" style="width: 100%;"> <tr> <th style="text-align: left;">Included</th> <th style="text-align: left;">Optional</th> </tr> <tr> <td>• Two M42 nuts</td> <td></td> </tr> </table>	Included	Optional	• Two M42 nuts	
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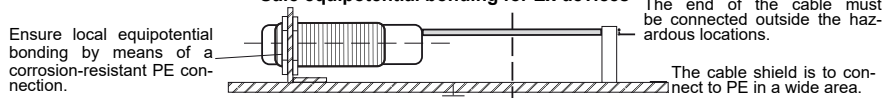
#### Wiring and Dimensions

1) yellow: RX+/DC+ (PoE mode A)	5) grey: DC+ (PoE mode B)
2) green: RX-/DC+ (PoE mode A)	6) red: TX-/DC- (PoE mode A)
3) black: TX+/DC- (PoE mode A)	7) blue: DC- (PoE mode B)
4) orange: DC+ (PoE mode B)	8) brown: DC- (PoE mode B)

Connect shield to  $\perp$  protection earth (over RJ45 plug)  
Wiring according to ANSI/TIA/EIA 568-A and IEEE 802.3af-2003



#### Safe equipotential bonding for Ex devices



#### EX related markings

CE 1258  
 Typ: CVG-SAB-WCA-TF  
 Gas:  $\text{II 2(1)G Ex db [op is Ga] IIC T4 Gb}$   
 ATEX:  
 IECEx:  
 Tamb:  
 Manufacturing date:

Manufacturer with Address  
 Electrical data according table  
 Dust:  $\text{II 2(1)D Ex tb [op is Da] IIIC T135°C Db}$   
 BVS 10 ATEX E130 X  
 IECEx BVS 14.0108X  
 0°C up to +50°C  
 Number 5 to 8 of the Serial Number (Year / CW)

CVG-SAB-WCA-TF\_e4/2023-07-17/IMP

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## Operating Manual / EU-declaration of conformity

### Product description

The CVG-SAB-WCA-TF camera system is intended for surveillance, code detection and image inspection within potentially explosive atmospheres. It must be installed and operated in accordance to this operating manual.

### General installation prescriptions

The equipment must not be used as personal protective equipment (PPE). The mounting, wiring, application and maintenance must be realized in accordance with the relevant rules and prescriptions. It is necessary to take into consideration the relevant international and national regulations.

### Ex installation prescriptions

It is necessary to take into consideration the valid international and national rules and regulations (IEC 60079-14). The maximum ratings must not be exceeded. The electrical connections must be done according to the wiring diagram. The local equipotential bonding must be connected corrosion resistant and permanently. The protective earth (PE) is solidly connected with the housing.

The cable shield must be solidly connected to protection earth. The cable have to be installed and protected against damages. The cable with termination fittings, or in cable tray systems and installed in a manner to avoid tensile stress at the termination fittings. To connect cables inside hazardous locations only use certificated Ex housings. All cable terminals must be connected outside hazardous locations.

Other than original manufacturer, additional optical lenses are not allowed in hazardous locations.

The product CVG-SAB-WCA-TF may only be installed and operated within Ex zones 1, 2, 21 and 22. The limited optical radiation may operate inside Ex zones 0 and 20.

### Open source software notice

This product uses open software, especially:

- Linux (GPL V2.0)
- OpenCV (3-Clause BSD License)
- GStreamer including Gst-RTSP-Server (LGPL and GPL)
- pymodbus (BSD License)
- Python with SciPy (PSF, GPL compatible, BSD License)
- ZBar and Python-ZBar (LGPL V2.1)

The source code of the most important libraries is stored on the device's internal memory at `/usr/local/src`. Please contact Tippkemper-Matrix GmbH if you wish to review the source code of further software packages. All product specific source code, developed by Tippkemper-Matrix GmbH, is provided under GPL V2.0. This product is powered by Raspberry Pi.

### Modbus TCP

Modbus TCP communication is organized in four types of registers:

#### 1. Register type: Coils (writable)

Address	Type	Function (default state underlined>
00001	Bit	Write 1 to trigger a scan in barcode or inspection mode
00002	Bit	Control internal illumination <u>0:off/1:on</u>
00003	Bit	Horizontal flip of image <u>0:off/1:on</u>
00004	Bit	Vertical flip of image <u>0:off/1:on</u>
00005	Bit	Image noise filter <u>0:off/1:on</u>
00006	Bit	Write 1 to make the last image
00007	Bit	Continuous scan trigger <u>0:off/1:on</u>

Write trigger bit at address 00001 to initiate scan of barcode or image inspection. The bit will automatically reset once the scan is completed. The continues trigger bit at address 00007 will not reset and will put the device in continuous scanning operation.

#### 2. Register type: Discrete inputs (read only)

Address	Type	Function (default state underlined)
10001	Bit	Service available <u>true/false</u>
10002	Bit	Binary image inspection result <u>accepted/not accepted</u>

Service available bit indicates if a valid configuration was set. The binary result of the image inspector is a truth value of a comparison from the image similarity and the threshold value in image comparison mode. In object count mode it will be true if the number of count objects is within the target range.

#### 3. Register type: Input Registers (read only)

Address	Type	Function
30001	3x uint16	MAC Address: 01=HighByte,02=MidByte,03=LowByte
30004	uint32	time stamp of scan result (unix epoch)
30006	string[8]	1 Code type
30010	string[256]	1 Code content
30138	string[8]	2 Code type
30142	string[256]	2 Code content
30270	string[8]	3 Code type
30274	string[256]	3 Code content
30402	string[8]	4 Code type
30406	string[256]	4 Code content

The time stamp provides the number of seconds since the 1. January 1970 at 0 o'clock, known as Unix timestamp. The timestamp is only valid, if the device can access a public NTP server. It can be configured to use internal NTP servers by manually modifying `/etc/ntp.conf`. Otherwise, the timestamp will be a random value. Nevertheless, even without an NTP server, the timestamps can still be compared to measure the time between two scans. All further data fields of the input registers provide data from the last code scan or image inspection. Up to four symbols can be read per scan in code detection mode, thus there are four instances of the code result fields. The fields containing the code type are filled with the string NONETYPE if no symbol was detected or with one of the following type strings: CODE39, CODE128, EAN8, EAN13, I25, UPCA, UPCE or QRCODE. Each code type field is followed by the corresponding code content field. The maximum symbol length is restricted by the field size of 256 characters.

#### 4. Register type: Hold registers (writable)

Ad- dress	Type	Function
40001	int32	Mode of operation
40003	int32	White balance mode (see table for possible values)
40005	float32	image x offset (0.0 to 1.0)
40007	float32	image y offset (0.0 to 1.0)
40009	float32	image width (0.0 to 1.0)
40011	float32	image height (0.0 to 1.0)
40013	int32	High dynamic range (0:off to 3:high)
40015	int32	Shutter speed (0:auto, 1µs to 100'000µs, depending on frames per second)
40017	int32	ISO mode (0:auto, ISO 100 to ISO 800)
40019	int32	Saturation (0 to 100, 0:neutral)
40021	int32	Contrast (0 to 100, 0:neutral)
40023	int32	Brightness (0 to 100, 50:neutral)
40025	int32	Sharpness (0:neutral to 100:enhanced)
40027	int32	Frames per second (15Hz to 30Hz or 90 if resolution is 640x480)
40029	int32	Bitrate (200'000 to 20'000'000bps)
40031	uint32	Static IPv4 device address (192.168.200.200)
40033	uint32	Static IPv4 subnetmask (255.255.255.0)
40035	uint32	Static IPv4 gateway address (192.168.200.1)

The mode of operation field can be used to restore a system preset, which can always be altered afterwards (e.g., by setting a fixed shutter speed). The following preset modes are available:

Mode	Description	Resolution	Frame rate	Bit rate
000	Standard video	1640x1232	30 fps	8 Mbit/s
001	High frame rate	640x480	90 fps	10 Mbit/s
002	Low bandwidth	640x480	15 fps	0.5 Mbit/s
003	Full HD 1080p	1920x1080	30 fps	10 Mbit/s
004	HD 720p	1280x720	30 fps	5 Mbit/s
005	Barcode mode	640x480		
006	HD Barcode mode	1920x1080		
1006	Image mode	3280x2464		

Using photo mode new images can be accessed at anytime under `http://<IP of CVD>/snapshot.<jpg/bgr/rgb/yuv>`. The file extensions determine the picture format. Please note that file extensions `.bgr`, `.rgb` and `.yuv` produce raw data without header.

The ISO mode field supports 0 for automatic gain and each of the following values: 100, 200, 400, 800.

There are six modes available for white balancing:

Mode	Description
0	No white balancing
1	Automatic white balance
2	Sunlight, about 5200K
3	Cloudy, about 6000K
4	Shade, about 8000K
5	Tungsten bulb, about 2800K
6	Fluorescent lamp, about 4200K

### General safety

The sensor must not be used for Accident-Prevention! In worst case the output can change to any state! When installing and operating the product, it is necessary to take into consideration all relevant international and other national regulations, especially those regarding explosion protection.

### Maintenance

No special maintenance is required.

The equipment must only be repaired or serviced by the manufacturer.

### General notes and disposal

We reserve the right to modify our products. Our products are designed in such a way, that it has the least possible adverse effect on the environment. It neither emits or contains any damaging or siliconized substances and use a minimum of energy and resources. No longer usable or irreparable units must be disposed of in accordance with local waste disposal regulations.


### EU-Declaration of Conformity

The product meets the requirements of the following standards and directives:  
EN/IEC 60079-0:2018, EN 60079-1:2014, EN 60079-28:2015, EN 60079-31:2014, EN 60529:2014, EN 61000-6-2:2005, EN 61000-6-3:2007 + A1:2011, ATEX directive 2014/34/EU, Machine directive 2006/42/EC, EMC directive 2014/30/EU, RoHS directive 2011/65/EU  
ATEX/IECEx-Designation:

Gas: II 2(1)G Ex db [op is Ga] IIC T4 Gb  
Dust: II 2(1)D Ex tb [op is Da] IIIC T135°C Db  
ATEX EU-type examination certificate No.: BVS 10 ATEX E130 X  
IECEX CoC No.: IECEX BVS 14.0108X  
Ex CB IECEX: DEKRA Testing and Certification GmbH, Carl-Beyling-Haus, Dinen-dahlstrasse 9, D-44809 Bochum, Ident number: 0158.  
ATEX certification of quality management system, type production of Ex devices, in accordance to the directive 2014/34/EU:  
Certification No.: SEV 21 ATEX 4580, QAR No.: CH/SEV/QAR21.0009/01, CB: Eurofins Elec-tric & Electronic Product Testing AG, Luppemstrasse 3, CH-8320 Fehraltorf CE 1258 Ident. Number: 1258

Pablo Ledergerber, Matrix Elektronik AG, is authorized to generation of documentation. The conformity of the devices with all used standards and directives and the EC-type exami-nation certificate and the observation of the Quality Management System ISO 9001:2015, de-clares:

Ehrendingen, 17.7.2023

  
Pablo Ledergerber, Matrix Elektronik AG